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AUTHOR Flagg, Barbara N.; And Others
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ABSTRACT

Two experiments were conducted to explore the role of pictures in comprehension and recall of written text and the effects of pictures on eye movement patterns during reading. Conducted in a laboratory setting, the first experiment examined the effects of three picture conditions (picture before text, picture with text, and no picture) on free and probed recall. Subjects were 48 third and fifth grade students. Although the results indicated no effects of pictures, grade level, or text type on recall of text, there were significant reading level differences in free recall and in certain eye movement patterns. The rated importance of a syntactic text unit was significantly related to free and probed recall as well as to eye movement patterns, and interacted significantly with reading level and text type. The second experiment was conducted in a classroom setting with 185 fourth grade students. To further examine picture-text interactions, the original three picture conditions were compared using expository texts that were easy to read and similar texts rated more difficult. Written free recall protocols were analyzed in terms of relative importance of different text units. Again there were no main effects of pictures, but significant interactions were found among reading level, importance level, and picture condition. (Author/RL)

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COMPREHENSION OF TEXT AND PICTURES

Barbara N. Flagg and Phyllis A. Weaver
with Terence Fenton, Roberta Gelatt, and Roger Pray

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Harvard University
Larsen Hall
Cambridge, MA 02138

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Abstract

This is the final report on a two-year grant to examine the role of pictures in comprehending and recalling written text and the effects of pictures on eye movement patterns during reading. Two experiments were performed, each exploring the interrelations among several variables.

The first experiment was conducted in a laboratory setting. For skilled and less skilled readers in third and fifth grades, we examined the effects on free and probed recall of three picture conditions (picture before text, picture with text, and no picture) and two text types (narrative and expository). Eye movements were recorded during reading. Results indicated no effects of pictures, grade level, and text type on recall of text. There were, however, significant reading level differences in free recall and in certain eye movement patterns. In a post hoc analysis, the rated importance of a syntactic text unit was significantly related to free and probed recall as well as eye movement patterns and interacted significantly with reading level and text type. Experiment 1 suggested that there are interesting interactions to pursue among reading level, text importance level, and picture condition.

The second experiment was conducted in the more naturalistic environment of the classroom. To further examine picture-text interactions, we compared the original three picture conditions using expository texts that were easily read and those rated as more difficult. Skilled and less skilled fourth grade readers participated. Written free recall protocols were analyzed in terms of relative importance of different text units. Again there were no main effects of pictures but there was a significant interaction among reading level, importance level, and picture condition.

Our results indicate that there is no simple effect of illustrations facilitating or disrupting comprehension of text. Picture effects are defined in part by the text structure and the skill of the reader. These results reinforce the need to refine reading models and their experimental effects so these interactions can be examined with increased precision.

Recent research in psychology, linguistics, and artificial intelligence has made it increasingly clear that readers or listeners construct the meaning of discourse by integrating information gleaned from the written or spoken text with their own previously acquired knowledge. Readers and listeners use clues provided by the texts, and these clues may include not only the words and structure of the text but also any relevant extra-linguistic information such as knowledge about its speaker or writer and the context in which it was produced. The task of comprehending is then one of recognizing these clues and combining them in a way that most nearly captures the meaning intended by the speaker or writer. It would seem that oral language situations generally provide a far richer and more accessible set of comprehension clues than do written language situations, and that inabilities to compensate for this difference may be a source of reading difficulty. Contrasts between oral and written language, with oral language situations being apparently more informative, led us to speculate that pictures accompanying written texts might enable the reader to compensate for the relative lack of explicit clues to meaning. Our goal in the research reported here was to examine the role of pictures in the process of reading comprehension and recall.

Oral language situations generally provide more clues, aside from the words themselves, which the listener can use to construct or corroborate interpretations of the text. In most oral language situations the child experiences, he or she shares a single frame of time and space with the speaker; this allows for much of the speaker's meaning to be inferred from or at least reinforced by the extra-linguistic context. The speaker can also convey meaning through gestures, facial expressions, and the tone and stress patterns of his or her voice. At the same time the speaker signals the phrasal and clausal structure of the message through prosodics. Further, the child typically knows the speaker, and, perhaps more importantly, the speaker knows the child; thus, the linguistic exchange is often custom-tailored. The topics of conversation tend to be concrete or at least about referents that are already familiar to the child. Finally, the situation is interactive: the speaker will often know when the listener doesn't understand and will then try to clarify the message; or alternatively, the listener can ask questions of the speaker.

By contrast, written text typically carries none of these clues. The frame of reference for the text is removed from readers in both space and time; thus, readers must construct the context from the text itself. Except for punctuation, the only basis for segregating phrases and clauses is syntactic competence. The author is neither present nor known: the text is impersonal. And, although the material in primers is generally based on simple stereotyped schemata, when children are faced with more advanced texts -- when they are supposed to be reading to learn rather than learning to read -- even the subject matter tends to be new. Finally, because the author is unavailable, readers must have strategies for recognizing and overcoming comprehension difficulties on their own.

Thus, in contrast to the speaker and listener, the writer and reader only have words to work with and this requires that certain adjustments be made by each. The writer must be much more thorough and precise than would be necessary in conversation. Given the lack of extra-linguistic support and the fact that the writer can presume very little about the knowledge of the reader, he or she must explicitly describe many details that would probably be taken for granted in a face-to-face interaction. In addition, the writer must carefully structure descriptions so as to communicate the interrelations among details and their relative importance to the overall theme. Further, as the number of explicitly introduced concepts increases, so too must the difficulty of keeping them straight. Thus, the writer must be meticulous in the use of pronouns and other referential or anaphoric devices. All of this assumes that readers have a degree of linguistic sophistication that is rarely required in oral language situations. Such a conception of language comprehension would make pictures an attractive aid to text processing. Pictures can provide clues to meaning otherwise missing in the written text, thus somewhat narrowing the gap, at least in theory, between oral and written language situations.

On the other hand, we also speculated that pictures can offer only rather coarse depictions of the quite precise, albeit portentially inaccessible, information provided in written discourse. Fine nuances, abstractions, and complex interrelations often can only be described with words. For the good reader (i.e., one who can automatically recognize words), pictures may be superfluous, unnecessary since accurate interpretation of the words plus text-based inferences ought to be sufficient for gaining literal meaning. Moreover, for the efficient reader, so little effort is expended on lower level processes, that there is usually ample time during which available attention and memory resources can be devoted to higher level analyses such as making inferences and evaluating the author's intent. The inefficient reader (the nonautomatic decoder) might indeed benefit from the additional source of information provided by pictures. However, if we hold to the "limited capacity processor" model of reading, then the poor inefficient reader would probably exhaust the bulk of his or her resources on lower level text processing leaving none to devote to higher processing of text and pictures. Thus we have a possible paradox. The reader who might indeed be assisted by pictures probably hasn't the time to take advantage of the information provided by them. What's more, if he or she chooses to do so, it may be at the expense of gaining detailed literal meaning of the text. Thus, pictures may not help and may even hinder text comprehension.

Are Pictures Distractors or Facilitators?

The arguments for and against adjunct illustrations have been clearly stated in the research literature and yet not successfully tested with respect to children's comprehension of text. As we have mentioned, pictures are considered misleading distractors because they attract attention away from the printed word whose accurate identification is necessary for understanding the text (e.g., Samuels, 1970). Similarly, if we agree that the

reader has limited information processing capacity, then picture analysis would use attentional and memorial "space" that might more appropriately be applied to processing graphemic, syntactic, and semantic characteristics of text.

Conceived of as comprehension facilitators, pictures provide a source of extra-linguistic information that aid grasping the meaning of a text (e.g., Denburg, 1976-1977). Illustrations provide information that is redundant with the text but in a form readily comprehended by those familiar with the conventions of pictures and the methods of "reading" them. The child's interpretation of the pictorially provided cues should aid the ongoing analysis of the textual cues which hold the specific meanings of the discourse.

Unfortunately, the results of past research do not clearly support either of these viewpoints. Three studies have found that pictures have no significant effect, either positive or negative, on readers' comprehension. Pictures did not affect posttest results for first, second, and third graders using basal readers (Miller, 1938), nor did sixth and seventh graders' text comprehension benefit from pictures illustrating expository texts (Vernon, 1954). Even specific directions to use a picture did not help third and sixth graders' understanding of a paragraph's main idea (Koenke, 1968).

In addition to this inconclusive research, the findings of some studies contradict those of others. Weintraub (1960) found that pictures hindered second graders' comprehension of details and main ideas presented in a basal reader. But the elementary school children in Halbert's (1944) study recalled more relevant ideas from stories with pictures than from those without. Part of the confusion in the picture-text research may lie in the relationship of the picture to the text content. Halbert noted that pictures augment comprehension more when they are more relevant to the story. Peeck (1974) found that pictures facilitated fourth graders' performance on questions concerning illustrated narrative text content and picture content, but performance was not facilitated for unillustrated text information. On the other hand, Wardle (1977) found no differential influence on seventh graders' science text comprehension from pictures with differing amounts of text-relevant information.

Another important variable to consider in interpreting the research is the reading ability of the student. The preceding studies mentioned did not analyze this important variable. However, Bluth (1973) found that good second grade readers profited from pictures on two cloze passages, whereas poor readers performed equally well with or without pictures. Wardle (1977) found the reverse of Bluth in a study of older seventh grade subjects and expository science texts. Pictures facilitated the comprehension of poor readers but did not affect the good readers' performance. Perhaps younger good readers can use the information provided by pictures better than younger poor readers, and perhaps older good readers have no need to use pictures which are still helpful to older poor readers.

The picture-text research clearly lacks a central focus and raises more questions than it answers. The usefulness of pictures appears to depend not on the mere presence of pictures, but on specific characteristics of the reader, the picture and text, and the demands of the task. We need to consider interactions of reader characteristics such as age and reading ability as well as picture-text characteristics such as text type and picture relevance. And finally, a real-time measure of picture-text processing such as that provided by eye movement recording during reading should be quite informative with respect to when, how, and for whom pictures affect text processing and text recall.

The two experiments we discuss in the remaining sections of this report were originally designed to resolve some of the conflicting evidence in the research literature. It became clear to us early in our work that instead we needed to gather some additional basic information on pictures and text comprehension so that we and others might continue to sort out the complex dynamics involved in picture-text processing.

EXPERIMENT 1

The purpose of Experiment 1 was to examine the effects on reading comprehension of three picture conditions (Picture Before Text, Picture With Text, and No Picture) using two text types (Narrative and Expository) for two grades (Third and Fifth) and two reading levels (Skilled and Less Skilled). This design allows us to make developmental and reading skill level comparisons of expository and narrative texts, with and without pictures. The postreading comprehension procedures included both a free recall and a probed recall measure. Additionally, the study included the recording of readers' eye movement patterns while viewing the stimuli in order to examine more closely readers' actual use of pictures and their effects on the reading process as it occurs. Therefore, whether the pictures were distracting or facilitating, we could examine how the reader used the picture during the reading task.

Method

Subjects

Third and fifth grade volunteers were obtained from two middle-class Boston suburbs. Reading comprehension subtest scores from the Stanford Achievement Test and the California Achievement Test, administered by the schools, were used to define Skilled and Less Skilled reading groups within each class. The Skilled readers scored from one-half to one and one-half years above their grade level, while the Less Skilled readers scored between grade level and one year below. Forty-eight children participated, six in each treatment cell.

Materials

Texts. Six reading passages were developed, three expository and three narrative (see Appendix A for texts). All texts were written at a 3.3 Spache readability grade level with five sentences and 72 to 74 words. Each expository text described a different Australian animal which we assumed was unfamiliar to our students: the dingo; the kiwi; and the wombat. The narrative texts were adapted from existing stories, although the main character in each was again an unfamiliar Australian animal. There was little in the narratives that described the characteristics of the main character, although each picture depicted the animal.

Pictures. The colored picture for each text was a chalk and pencil drawing produced by one artist (see Appendix A for pictures). Each picture was as redundant as possible with the text with little or no extraneous information. For the narratives, the main action or immediate result of the action was depicted. For the expository texts, each animal was shown with as much visual detail as was employed in the text, and the animal was depicted participating in the activity described in the text.

Stimulus display. Each child viewed the texts and pictures on a 15.5" x 16" poster board, three feet away. The texts were typed with an IBM Courier typing element at 10 pitch and enlarged 200% so that 1° of visual angle subtended 3.15 character spaces. The distance between lines subtended 1° of visual angle also. Typically, we have found that pictures in reading series are placed after the textual material to which they refer. Therefore, in all experimental conditions the text appeared in the upper half of the stimulus display. When the picture was present, with or without text, it appeared in the lower half of the display.

Apparatus

Gulf & Western Model 1994 Eye Movement Monitoring System was employed to record eye activity while students read the passages. Each child sat in a comfortable adjustable chair about three feet from the stimulus display. The recording system allows small head movements by employing only a padded headrest surrounding the temples and back of the student's head. A small television camera located out of direct field of view, 15" from the viewer, records data from the reader's left eye. The system does not interfere with the student's normal reading. Eye position was sampled 30 times per second, and a fixation was defined with a minimum duration of 100 msec. and a maximum radius of about 1 degree.

Procedures

After a student was settled into the experimental situation and the recording equipment was calibrated, a warm up or sample text without illustration was shown, followed by four short comprehension questions to insure that the subjects would read the targets texts carefully (see Appendix A for warm up text). Subsequently, a set of three stories (narrative or expository) were presented one after another with no intervening questions. Every student read three texts, each under a different picture condition: Picture Before Text; Picture With Text; and No Picture. In the Picture Before Text condition, the reader viewed the picture for eight seconds before the text was displayed. The picture conditions were counterbalanced across individual texts, and the order of presentation of texts was counterbalanced across students.

Instructions were given to read and look at the materials as though the stories and pictures were in a school book. The students were asked to read very carefully because they would be asked to retell each story and answer questions about each one. The students read silently while their eye movements were recorded.

After the third story was read, free recall and probed recall data were collected. Each student was asked to retell the stories exactly as remembered, one at a time, in the order that they were presented. Following the third story, the student was asked to answer a set of questions for each story, again preserving the order of story presentation. The questions probed for information at the clause level and sometimes the phrase level, and every clause was probed (see Appendix B for questions).

For analysis, each stimulus text was divided into the syntactic units of independent clauses, dependent clauses, and phrases. Scoring credit was given for a unit if the recall protocol contained information given in that unit. Interrater reliability was .95 for free recall and .98 for probed recall.

Results

Recall

The free and probed recall data were analyzed by four-way ANOVAs for each separate text (Dingo, Kiwi, and Wombat) with main effects of Grade (Third vs. Fifth), Reading Level (Skilled vs. Less Skilled), Text Type (Narrative vs. Expository), and Picture Condition (Picture Before Text, Picture With Text, vs. No Picture). The dependent measure for these analyses was the percent of syntactic units correctly recalled from a text. The main effects of Grade, Text Type, and Picture Condition were not significant for either free or probed recall. Reading Level was a significant effect only on the free recall of four out of the six texts ($p < .01$); that is, Skilled readers spontaneously recalled a greater percentage of the passages than did Less Skilled readers, regardless of grade, text type, or picture presence. When we compared reading groups on probed recall, the Less Skilled readers closed the gap and recalled almost as much textual material as did the Skilled readers. Tables 1 and 2 present the mean free recall data for Skilled and Less Skilled readers for all texts combined.

Table 1

Percent of Textual Units Recalled Correctly on Free Recall Task for All Texts Combined

Importance Level	Reading Level: Skilled	Less Skilled	Total
High	36.4%	18.6%	27.5%
Low	17.7	10.5	14.1
Total	27.0	14.6	20.8

Table 2

Percent of Textual Units Recalled Correctly on Probed Recall Task for All Texts Combined

Importance Level	Reading Level: Skilled	Less Skilled	Total
High	58.0%	45.2%	51.6%
Low	31.9	28.3	30.1
Total	44.9	36.7	40.8

Although Text Type was not a significant effect in our initial analysis, a finer grained examination of the pattern of recall of the syntactic textual units yielded interesting results. A class of 30 graduate students in education were asked to rank the syntactic units in importance quartiles from least to most important. The mode ranking was used then to classify the relative importance level of each textual unit. For analysis, the highest two quartile ranks were collapsed and the lowest two ranks were merged to form the within-subjects variable of Importance Level (High vs. Low). For example, in the sentence "Dingoes are wild dogs that live in Australia," the High Importance material was "Dingoes are wild dogs" and the remainder of the sentence was classified as Low Importance information relative to the text as a whole. Split-plot ANOVAs were used to analyze the comprehension data for all texts combined, with Importance Level as the within-subjects variable and Reading Level, Grade, and Text Type as the between-subjects main effects.

The main effect of Importance Level proved to be highly significant for both free and probed recall, $F(1,40) = 76.05$, $p < .001$; $F(1,40) = 100.58$, $p < .001$, respectively. The students recalled a significantly larger percentage of text material ranked High in importance as opposed to Low. Importance Level also showed a significant interaction with Reading Level for both free and probed recall data, $F(1,40) = 11.97$, $p < .01$; $F(1,40) = 4.53$, $p < .05$, respectively. Both reading levels recalled High Importance units better than Low Importance material, but there was a much greater discrepancy between Skilled and Less Skilled readers on recall of High Importance information than on the Low Importance text (see Tables 1 and 2).

Finally, the Importance Level x Text Type interaction was significant for probed recall and just missed significance for the free recall data,

$F(1,40) = 30.31$, $p < .001$; $F(1,40) = 3.79$, $p = .059$, respectively. High Importance units were better recalled than Low Importance material for both text types, but the discrepancy between recall of high and low units was much greater for the Narrative than for the Expository texts. For Narrative passages, the difference in recall of High and Low Importance material was much larger than for the Expository passages.

Eye Movement Patterns

Eye movement data were analyzed by means of a split-plot ANOVA with Text Type (Expository vs. Narrative), Grade (Third vs. Fifth) and Reading Level (High vs. Low) as between-subjects variables, and with Picture Condition (Picture Before vs. Picture With vs. No Picture) and Importance Level (High vs. Low) as within-subjects variables. The dependent variable in this analysis was fixation time per text character. This measure was designed to adjust for the fact that the number of character spaces that were included in High Importance text sections exceeded those in Low Importance areas. It also served to remove any bias due to slight variations in the number of characters across the individual texts.

Table 3 presents the mean fixation times as well as a summary of the main effects of the eye movement analysis. In general, forward moving fixations consumed 123 msec of fixation time per text character, while regressions (i.e., fixations which take the reader back into the text to reread) accounted for 28 msec/character. Thus 20% of reading time was taken up by regressions.

Surprisingly, expository text appeared to be read somewhat more rapidly than narrative text, although the analysis of variance revealed that the differences between expository and narrative fixation times were not statistically significant. Thus we cannot conclude that the variation of text type that was employed in this study was associated with differences in duration of fixations.

Analysis of Grade Level differences revealed that the Third Graders exhibited significantly longer fixation times than the Fifth Graders (see Table 3). This was true for both forward fixations and regressions, $F(1,39) = 7.67$; $p < .01$; $F(1,39) = 4.32$; $p < .05$, respectively.

Fixation times were also found to be significantly related to Reading Level. Skilled readers consumed 104 msec/character for forward fixations while Less Skilled readers required 142 msec/character, $F(1,39) = 13.31$; $p < .001$. On regressions, there was a significant Skilled group versus Less Skilled group discrepancy of 12 msec/character, $F(1.39) = 6.17$, $p < .05$.

Fixation time on the texts differed only slightly as a function of Picture Condition, and the small differences that did occur were not statistically significant (see Table 3). Thus the data provide no evidence that pictures are either a help or a hindrance with respect to overall speed of reading text.

Table 3

Mean Fixation Duration (in msec) per Character

	Forward Fixations (in msec)	Regressions (in msec)
All Texts	123	28
Expository	118	26
Narrative	129	30
Third Grade	138	33
Fifth Grade	109**	23*
Skilled Readers	104	22
Less Skilled Readers	142***	34*
Picture Before	125	30
Picture With	123	28
No Picture	123	26
High Importance	126	29
Low Importance	121*	27

*$p < .05$

**$p < .01$

***$p < .001$

On the average, the subjects devoted longer fixations to High Importance areas than to Low Importance material (see Table 3). This effect was statistically significant with respect to forward fixations, $F(1.39) = 5.12$; $p < .05$, but this finding did not prove to be statistically significant for regressions.

For regressions, three two-way interactions were significant in the ANOVA analysis: Reading Level x Picture Condition, $F(2,78) = 5.11$, $p < .01$; Grade x Importance Level, $F(1,39) = 5.19$, $p < .05$; and Reading

Level x Importance Level, $F(1,39) = 5.85$, $p < .05$. Tables 4-6 present the mean regression times (in msec) for these interactions.

Table 4 demonstrates that Skilled readers exhibited similar regression times within the text regardless of Picture Condition. However, the regression durations of the Less Skilled readers were longer when a picture was presented, either before or during the text display. Thus, pictures appear to promote longer regression times among Less Skilled readers. This may reflect extra time required to integrate additional pictured information.

Table 5 shows that Fifth graders fixate longer on High Importance areas during regressions, while Third graders do not differentiate by importance. This result suggests that the older students have a greater tendency to regress to the text highlights than to details.

In Table 6 we see Less Skilled readers exhibited longer regression times on High Importance areas, while the Skilled readers showed a slight tendency in the opposite direction. This finding may reflect the fact that the Less Skilled readers spend a great deal of that regression time on the unfamiliar words (e.g., animal names) which tended to fall in the areas of the text rated as High Importance.

Eye Movement Patterns and Recall

We are currently analyzing the correlations of our two data sets to determine whether a reader's scan pattern over a text is significantly related to recall of particular text or picture information. We have analyzed in more detail, however, the Picture With Text condition. Although pictures presented with the text stimuli did not significantly facilitate recall overall, the eye movement data showed that the pictures were indeed looked at by the majority of the students during the Picture With condition. When we examined the percent of time spent scanning the pictures or the percent of total eye fixations directed toward the picture, we found no significant differences between Grades, Reading Levels, or Text Types. Thus, although picture usage varied from 0% to 20% of viewing time with an average of 5.6%, no strong systematic relationships were found with Grade Level, Reading Level, or Text Type.

The eye movement analysis of the Picture With condition identified a wide range of picture usage patterns which crossed boundaries of grade, reading skill, and text category. Eight percent of the 48 children ignored the picture completely. Seventeen percent looked at the picture both before and after reading but not while reading the passage, while 23% either examined the picture completely before or after they read the text through without interruption. Finally, 52% of the children interrupted their reading at least once to scan the picture, and within this last group, half of the students left the text more than once to scan the picture. Thus, picture usage in the Picture With condition was idiosyncratic with no subsample showing a consistent homogeneous picture viewing pattern.

Table 4

Mean Regression Times for Reading Level x Picture Condition Interaction

	Picture Before	Picture With	No Picture
Skilled Readers	23	23	21
Less Skilled Readers	28	34	38

Table 5

Mean Regression Times for Grade x Importance Level Interaction

	High Importance	Low Importance
Third Grade	32	33
Fifth Grade	26	21

Table 6

Mean Regression Times for Reading Level x Importance Level Interaction

	High Importance	Low Importance
Skilled Readers	21	23
Less Skilled Readers	36	31

The interesting findings appear when we look at the correlations between the picture viewing data and recall of High or Low importance units for the Picture With condition. The recall of High Importance material was not significantly correlated with the percent of time or percent of fixations on the pictures. There were, however, significant correlations between picture usage and recall of Low Importance text units. For both free and probed situations, recall of Low Importance text was significantly correlated with percent of time spent looking at the pictures, $r(46) = .322, .336$; $p < .05$, respectively. The percent of fixations on the pictures was also significantly correlated with free recall of Low Importance units but not with probed recall, $r = .365$, $p < .01$.

Discussion

The recall and eye movement data showed few effects of pictures, either positive or negative. Pictures did appear to encourage significantly longer text regression durations for less skilled readers, suggesting that this reading group needed more time to integrate picture information with the text. Pictures, indeed, may put an extra processing load on poorer readers, but not enough to affect recall as we measured it. Secondly, during the Picture With Text condition, we found that more attention to the picture related significantly to better recall of low level syntactic units. These results suggest that pictures perhaps provide a mental image to help stimulate later recall of text details which were more difficult to remember for all our readers.

The lack of general picture effects may be a function of the third grade readability of the stimulus texts. Because the passages were fairly easy to decode, the readers were not pushed to seek extra-linguistic information to comprehend the texts. The pictures were not necessary for efficient comprehension of the material. This interpretation of the results would suggest that presentation of more difficult texts, beyond the readers' abilities, would encourage utilization of adjunct pictures. We test this hypothesis in Experiment 2. Secondly, the laboratory setting may have somehow obscured the picture effects, so our second study employs a classroom environment.

To our surprise, text type -- expository or narrative -- was not a major factor in either recall or eye movement patterns. Although narrative texts were easier to recall, the overall difference was not significant. However, the significant interaction of text type and Importance Level shows that our middle grade readers were sensitive to text structure differences between narrative and expository texts. The results suggest that the readers applied a narrative structure schema which successfully differentiated High Importance from Low Importance information and concentrated their energies appropriately on retaining the higher ranked material. The readers were less successful at determining which textual units of the expository passages were more important to understand and recall, so for expository texts there was a smaller difference between recall of higher and lower ranked units.

Perhaps lack of experience with expository material limits the development of an effective schema for comprehension of this text type. We concentrate on analyzing expository texts further in Experiment 2.

The two reading skill levels differed significantly, as expected. The skilled readers read faster, with less forward fixation time and regression time. The skilled readers recalled more material during the free recall task but not during the probed recall task. The reading group differences are thus somewhat a function of the comprehension task, with high free recall perhaps requiring the better verbal and memory abilities of the skilled readers. The skilled readers recalled the High Importance material much better than the less skilled readers, even though the latter group actually spent significantly more fixation time than the skilled readers did on these highly rated areas than on Less Important text units. Both reading groups seem to be able to discriminate the most important textual information, as indicated by our recall and eye movement data, although the skilled readers show much more spontaneous recall of this material than the less skilled group. The implication here is that the less skilled reader with limited resources, devoted a disproportionate amount of time to information known to be important. Thus, we suspect the reader does not suffer from an insensitivity to what is important. On the contrary, he seems to know this well, perhaps even choosing to sacrifice detail for the sake of capturing the important information. Rather than having comprehension problems, per se, these results lead us to speculate that inefficient, slow decoding may masquerade as poor comprehension. Further investigation of this reading level/importance level interaction occurs in our design for the second experiment.

Finally, grade level differences did not figure largely in recall or eye movement data. No differences occurred in recall; the fifth graders exhibited significantly shorter text fixation durations and a greater tendency to regress to High Importance areas than to Low. The absence of third and fifth grade differences here led to our decision to use only one grade level in Experiment 2, and we selected to study the fourth grade, that in between the two.

EXPERIMENT 2

The previous experiment found that illustrations had little effect on recall and comprehension of text. Among the several reasons proposed to explain these counter-intuitive results were the use of a laboratory test setting and the easy readability of the texts. The second experiment was designed to speak to these and certain other issues.

One major aim of Experiment 2 was to examine the effect of illustrations upon comprehension of text in a natural classroom environment. The three picture conditions used in Experiment 1 were repeated in Experiment 2: Picture Before Text; Picture With Text; and No Picture. The stimulus texts were restricted to expository style and were presented on two levels of difficulty for each student, since a second major purpose of our study was to examine the idea that pictures may have their greatest effects when readers encounter problems in comprehension. As in Experiment 1, the second experiment involved two reading levels -- Skilled and Less Skilled -- and analyzed recall in terms of the rated importance of textual units. We wished to examine (a) whether illustrations would help readers to better recall the highlights or details of a text and (b) whether discrimination between high and low importance material would be more apparent in recall patterns of skilled readers than those of less skilled readers. Thus, Experiment 2 was a split-plot design, 3(Picture Condition) x 2 (Text Difficulty) x 2 (Reading Level) x 2 (Text Importance Level).

Method

Subjects

A total of 155 Fourth grade children participated from three public schools in Somerville, MA., a predominantly lower SES suburb of Boston. On the basis of reading teacher ratings, students were assigned to two reading level groups: Skilled -- above fourth grade level reading ability -- and Less Skilled -- on or below grade level. Stanford Diagnostic Reading Comprehension Test scores were available for 85% of the participants in the Spring after completion of this study. The Skilled group yielded a mean grade level of 6.1; the Less Skilled group, 4.8.

Materials

Texts. An unfamiliar Australian animal was described in each of five expository passages, which were matched for length and content categories (see texts in Appendix A). As scored by the Spache readability coefficient, three levels of texts were written. At grade level 3.3 were Kiwi and Dingo (both used in the previous study); at level 4.0 were Cuscus and Numbat; and Cuscus was also rewritten to obtain a more difficult version with a readability grade level of 5.3. The passages differed mainly in sentence length, vocabulary difficulty, and linguistic structure of the sentences (see Appendix C).

Each student read one low level passage and one high level passage. One group of the Less Skilled fourth graders read the Kiwi (3.3) and Cuscus (4.0); a second group read the Dingo (3.3) and Numbat (4.0). The Skilled reading group read the Kiwi (3.3) and the more difficult Cuscus (5.3).

Pictures. The texts were illustrated by original black and white line drawings. The pictures presented information redundant with the text, with as little supplementary information as possible. Pictures for the Kiwi and Dingo stories were ink renditions of the larger color pictures used in the previous study. The pictures for the Cuscus and Numbat texts were drawn in a similar style (see Appendix C).

Test Booklets. All test booklets contained a cover page for student data, one reading passage, a connect-the-dots pencil task, and a lined sheet of paper. Depending upon the experimental condition, the booklet contained no pictures, a picture on the page preceding the text page, or a picture on the same page as the text. Each passage was typed double-spaced as a single paragraph on the upper half of standard size unlined paper turned sideways (i.e., in a 4½" x 11" space). The pictures occupied the lower half of the page, whether presented before or with the text. Blank pages preceded each picture and each passage to prevent advanced reading or viewing.

After the text page, a numbered connect-the-dot picture of an abstract shape constituted a masking task to interrupt the child's short term memory. The last lined sheet of the booklet was provided for written recall. Written instructions on top of the page requested: Please write everything you rememver about the "text animal." (Examples of the booklets are available in Appendix D.)

Procedures

The task entailed completing two booklets, one of which contained a story of low readability and one of high readability. The Less Skilled fourth grade readers were randomly assigned to either the Kiwi (3.3/Cuscus (4.0) texts or the Dingo (3.3/Numbat (4.0) texts. The Skilled readers read the Kiwi (3.3)/Cuscus (5.3) texts. Half of the students received the booklets in AB order, the other half in BA order.

Procedures were developed for the following three test conditions:

Picture Before Text. In this condition, students received a booklet with a picture appearing by itself on the first inside page. Subjects were asked to turn to the picture page and wait until instructed to proceed. A period of eight seconds elapsed after which students were asked to turn to the next page and read the passage at their own speed. After the first booklets were completed and collected, the procedure was repeated with the second booklet. This was the only test condition where booklets were distributed one at a time.

Picture With Text. Booklets were distributed with the pictures and text on the same page. Each subject received two booklets at the same time, and was asked to raise his or her hand after completing the first. The test administrator examined the finished booklet to make sure all parts were completed, then instructed the subject to follow the same procedure for the second booklet.

No Picture. Booklets for these subjects contained no pictures, either before or with the text. Two booklets were distributed, following the same procedure as for the Picture With Text condition.

Students were tested in group settings, usually in their individual reading group placements. Groups were assigned randomly to either the Picture Before condition or to a combined administration of the latter conditions. Students within the combined administration were randomly assigned to receive either Picture With Text booklets or No Picture booklets. Task instructions were read verbatim by one experimenter before the test session (see Appendix E).

Data Analysis

As in Experiment 1, the texts were divided into the syntactic units of independent clauses, dependent clauses, and phrases. Scoring credit was given for a unit if the recall protocol contained information given in that unit. Interrater reliability (percentage agreement) was .95 for the free recall data.

Also, as in Experiment 1, a class of 12 graduate students in education ranked the syntactic units in importance quartiles from least to most important. The mode ranking was used to classify the relative importance level of each textual unit, and again, the highest two levels and lowest two levels were merged to form the within-subjects variable of Importance Level (High vs. Low).

Results

Analysis of Variance with repeated measures was performed on the recall data for all five expository texts together: 3 (Picture Condition) x 2 (Text Difficulty) x 2 (Reading Level) x 2 (Text Importance Level). The main effect of Picture Condition was not significant (see Table 7). As expected the texts which differed in readability yielded differences in recall, such that the Easy passages (Kiwi, Dingo) were significantly easier to recall than the Hard passages (Cuscus, Numbat), $F(1,149) = 59.47$, $p < .001$. The Skilled readers also recalled significantly more of the texts than the Less Skilled group, ($F(1,149) = 15.13$, $p < .001$, and significantly more High Importance text units were recalled than Low Importance, $F(1,149) = 105.90$, $p < .001$.

One interaction was significant -- Picture Condition x Reading Level x Importance Level, $F(2,149) = 3.99$, $p < .02$. Examination of the recall

data in Table 7 helps us interpret this three-way interaction. For the Skilled readers, the presence of illustrations had no effect on recall of High Importance information but had a negative effect on recall of Low Importance material. For Less Skilled readers, pictures presented both before and with the texts slightly facilitated recall of High Importance text units and very much helped recall of Low Importance information. These same recall patterns occurred for both the difficult and easy texts.

Table 7

Percent of Textual Units Recalled Correctly (all texts combined)

Reading Level	Importance Level	Picture Condition: Before Text	With Text	None	Total
Skilled	High	52.2%	54.4%	52.5%	
	Low	35.7	31.5	44.3	
					45.1
Less Skilled	High	39.2	42.0	35.4	
	Low	30.1	29.9	20.2	
					32.8
Total		39.3	39.5	38.1	

Discussion

Experiment 2 attempted to shed light on some results of the first experiment by employing a natural classroom test setting and a larger range in text readability levels. Neither variable figured largely in the recall results. Pictures were not simply facilitative of text comprehension in the classroom and the difficulty of the text did not appear to affect the reader's use of the picture for comprehension.

As expected from our results of the first study, skilled readers recalled more than the less skilled group; more high importance text units were recalled than less informative units; and passages with high readability levels were harder to recall.

The Reading Level x Importance Level interaction which was significant in Experiment 1 showed up as a three-way interaction in Experiment 2: Reading Level x Importance Level x Picture Condition. Pictures were generally helpful for the less skilled readers for both high and low importance material, but for skilled readers pictures were neutral with respect to high ranked information and interfering with recall of the lower ranked material. This interaction was not significant in the first study where pictures had a neutral effect with the exception of facilitating recall of high importance text units by the skilled reading group.

Conclusions

Several conclusions can be drawn from the findings of the two studies presented in this report. First, it is quite evident that any effects of pictures on comprehension and recall are not simple or straightforward. There were no main effects of pictures, regardless of reading skill level, grade level, text type, or text difficulty. Because reading level differences in recall were strong, we are confident that the picture findings are stable and not due to artifacts of the experimental situation. This is strengthened further by the absence of eye movement effects across the different picture conditions as well as by the repetition of no picture effects relative to recall in the second study. In this second study, the conditions were refined to "force" the use of pictures, including carrying out the study in the classroom instead of the laboratory. Thus simply comparing overall comprehension and recall when pictures accompany text or do not, or when they precede text, is not an effective way to measure their power.

A second major finding from these two studies was the difference in reading behavior as a function of relative importance of text information. As in other studies, we found clear reading level differences associated with text information independently rated high or low in importance. These differences were also related to amount of information recalled, to eye fixation durations, and to picture conditions. Poor readers are much worse than good readers at remembering information high in importance,

with a reduced discrepancy in recall on less important information. Poor readers spend proportionately more time fixating on high importance information than good readers, a finding we speculate reflects a compensatory strategy. That is, we think because poor reading is usually synonymous with slow, inefficient word-level skills, displaying the bulk of limited resources to highly important information indicates poor readers are sensitive to different levels of importance but must work harder, at the expense of recall, to process this information. In other words, they "get less for more."

Different picture conditions interacted with reading level and importance level in the second study. This reinforces the need to refine reading models and their experimental effects so these interactions can be examined with increased precision. Moreover, we are still conducting eye movement analyses which will specify interrelations among picture information, text importance and reading skill. These analyses will help shed an interpretive light on the finding in our second study that pictures did help poor readers but for skilled readers were neutral when information was more important and interfered when information was less important.

Uncovering the sources and nature of reading difficulty has captured the attention of psychologists and educators. The paradigm we employed -- using eye movement recordings and comprehension measures to study picture-text interactions -- is a rich one for examining reader skill differences. We recommend continued efforts in this domain.

The pictures we paired with texts presented information redundant with that in the text. Thus our findings can only be interpreted with this restriction fully in mind. Higher level processes, such as making text-based inferences, are likely to produce different effects on picture usage and on comprehension and recall. Such work would make important contributions to the study of representation of information in memory as well as to the nature of individual differences in reading.

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APPENDIX A

EXPERIMENT 1

EXPERIMENTAL STIMULI

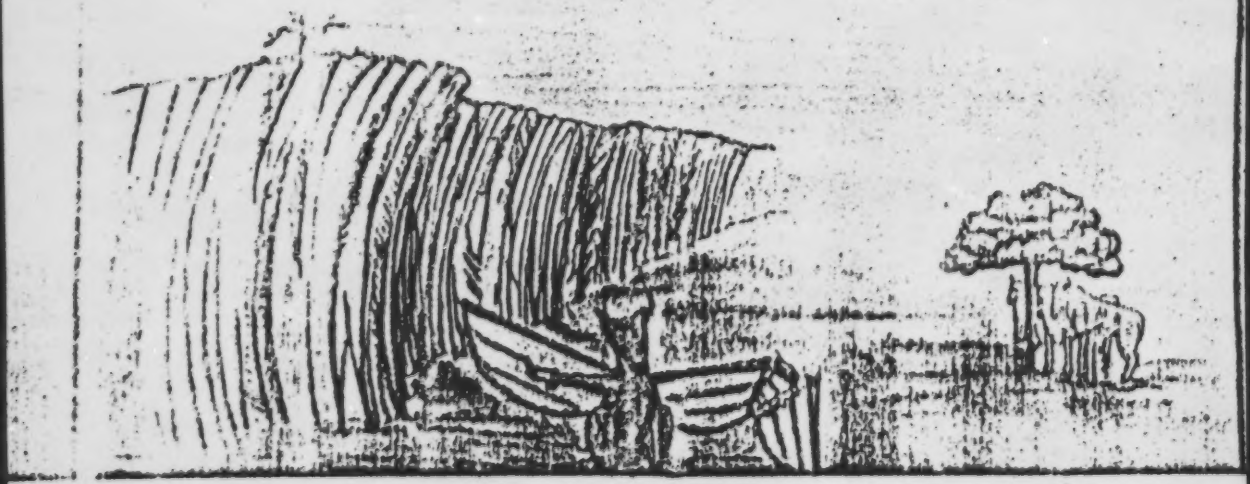
(These are xeroxes made from slides and the color is very distorted.)

One night Peter went to bed early. It was not dark. The bright moon shone in at the window. Peter could see everything in the room. All at once he heard a noise. Peter opened his eyes. He saw that the room had grown dark. Something was outside the window.

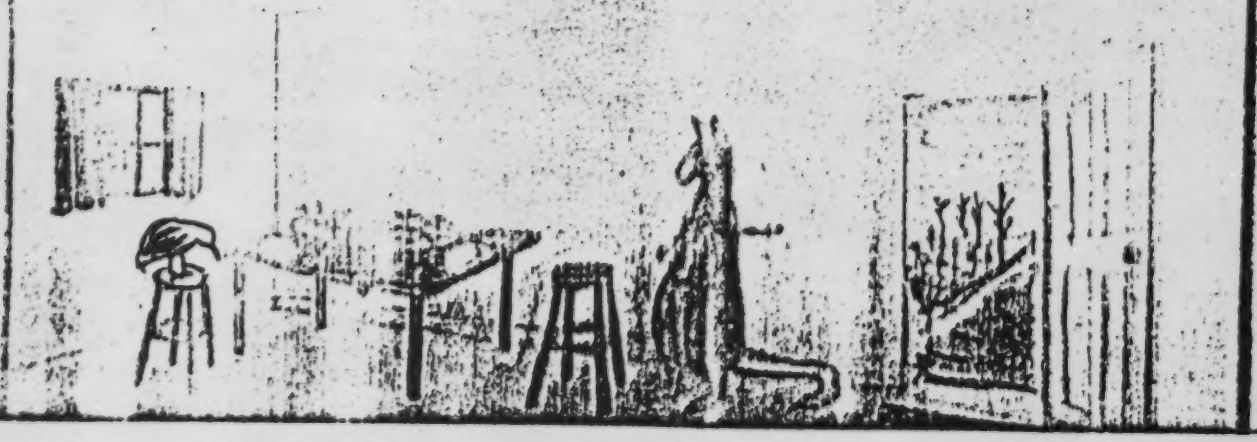
Tap, tap, came a noise at the window. "What is it?" called Peter. "It is I, Peter. Come to the window." Peter climbed out of bed and went to the window. There he saw a bird. This bird was so large that his eyes were as big as saucers.

"Hello, Peter," said the bird. "Hello," said Peter. "Who are you?" "I am a Fairy Bird."

A dingo wantud to fly like a bird, so he built a pair of wings. He put them on, walked to the edge of a cliff, and jumped into the air. He flapped his wings as rapidly as he could, but he fell to the earth. His friends watched him land and shouted, "Don't you know dingoes can't fly?" The dingo looked puzzled and replied, "The flying was easy, but the landing was hard."

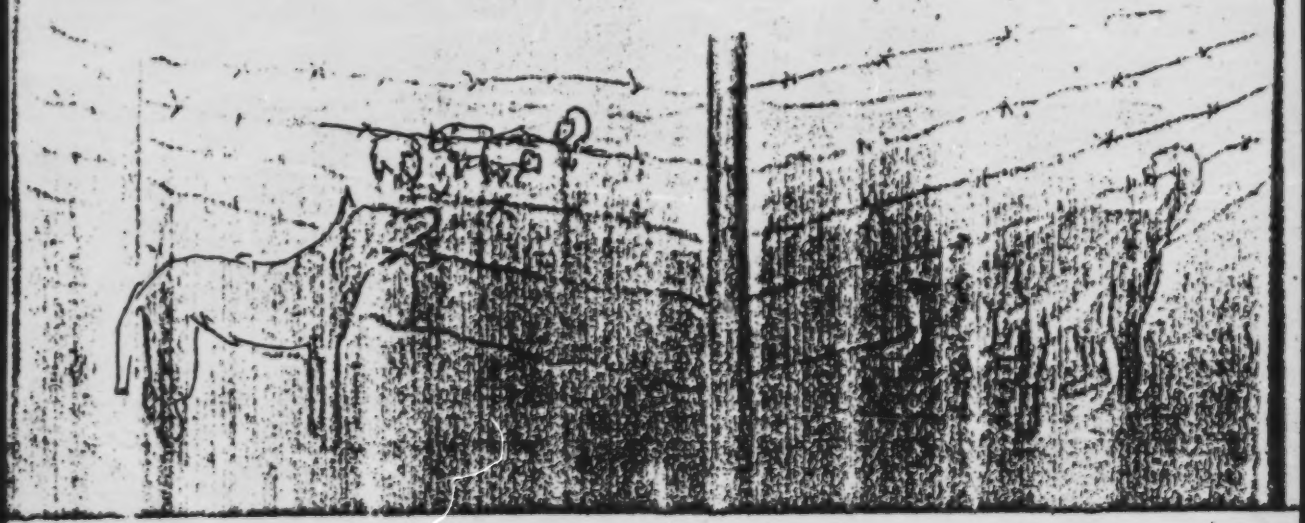


One day a kiwi was very hungry, so he went to the kangaroo's house for lunch. On the table there were special dishes like baked owl, fried frogs' legs, and elephants' ears. The kiwi shook his head because he didn't like this feast. The kangaroo pointed to the door and said, "Then go eat worms in the garden!" And out he went, because there is nothing kiwis enjoy more than long juicy worms.



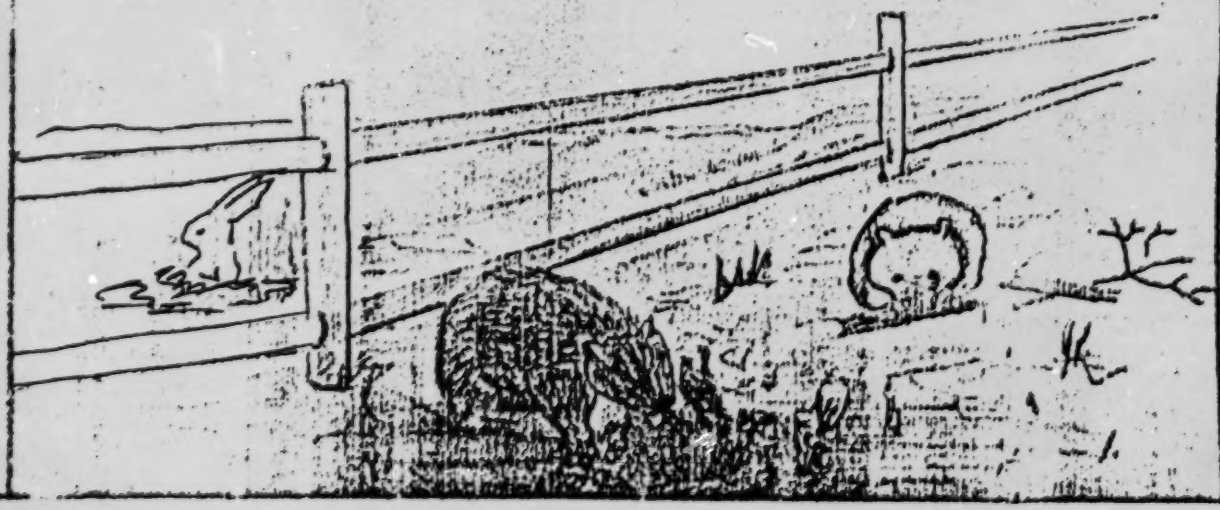
A wombat lived on a worn-out road. When it rained heavily, water filled the ruts to form deep puddles. One day it rained so hard there were more puddles than road. The wombat thought he would have to jump like a rabbit to get to school, and this gave him a good idea. He got his pogo stick from the basement and bounced happily down the road, until his books fell in the water.

Dingoes are wild dogs that live in Australia. They are about two feet tall with short soft fur, large pointed ears, and bushy tails. The dingo is the farmers' enemy because it kills their sheep for its food. To keep the dingoes away, the farmers built a 6,000 mile-long wire fence around the desert where most dingoes live. But the cunning dingoes find ways through the fence to get to the flocks of sheep.



The kiwi is a wingless bird from Australia with a long beak and feathers that are like silk thread. The kiwi runs on feet that have three toes. To find food, it taps its feet on the soil to make a noise that sounds like falling rain. The sound of pattering rain causes earthworms to come up out of the ground. When the kiwi taps, worms appear and the bird eats them.

Wombats look something like groundhogs and they live in Australia. They are built low to the ground with small eyes, a small nose, and almost no tail. Wombats eat grass, and they have large front teeth to chew on roots and bark. They use the strong digging claws on their short legs to burrow a hole into the ground where they live. Sometimes rabbits move into old wombat holes after the wombats have left.



APPENDIX B

Recall Questions for Experiment 1

PROBES: DINGO--NARRATIVE

(Now I'm going to ask you questions about the dingo story.)

1. What did he want to be able to do?
   (fly) (like a bird)

2. What did the dingo build?
   (a pair of wings)

3. What did he do with the pair of wings after he built them?
   (he put them on)

4. After he put them on, where did he walk?
   (to the edge of a cliff)

5. When he got to the edge of the cliff, what did he do?
   (jumped into the air)

6. After he jumped, what did he do with his wings?
   (flapped them as fast as he could)
   flapping his wings
7. Did ~~this~~ work? What happened?
   (No, he fell to the earth)

8. What did his friends shout as they watched him land?
   ("Don't you know dingoes can't fly?")

9. What did the puzzled dingo reply?
   ("The flying was easy, but the landing was hard.")

10. What is a dingo? Take a guess.
    (I don't know. Some kind of animal)

PROBES: KIWI--NARRATIVE

(Now I'm going to ask you questions about the kiwi story.)

1. Where did the kiwi go on the day he was very hungry?
   (he went to the kangaroo's house) (for lunch)

2. What special dishes were on the table?
   (baked owl) (fried frogs' legs) (elephants' ears)

3. Why did the kiwi shake his head?
   (because he didn't like the feast)

4. What did the kangaroo do about the kiwi not liking the feast?
   (pointed to the door)

5. And what did the kangaroo say as he pointed to the door?
   ("Then go eat worms in the garden!")

6. Then what did the kiwi do?
   (out he went (to the garden))

7. What do kiwis enjoy eating the most?
   (long juicy worms)

8. What is a kiwi? Take a guess.
   (I don't know. Some kind of animal)

PROBES: WOMBAT--NARRATIVE

(Now I'm going to ask you questions about the wombat story.)

1. Where did the wombat live?
   (on a worn-out road)

2. What happened to the road when it rained heavily?
   (water filled ruts) (formed deep puddles)

3. What was the road like on the day it rained so hard?
   (there were more puddles than road)

4. What did the wombat think he'd have to do to get to school?
   (jump like a rabbit)

5. What did he actually do about ~~this~~ the good idea he had?
   (got his pogo stick from the basement)

6. And then what did he do?
   (jumped happily down the road)

7. What happened as he was jumping down the road?
   (his books fell) (in the water)

8. What is a wombat? Take a guess.
   (I don't know. Some kind of animal)

PROBES: DINGO--EXPOSITORY

(Now I'm going to ask you some questions about the dingo story.)

1. What are dingoes?
   (wild dogs)

2. In what country do they live?
   (Australia)

3. What do they look like?
   (2 feet tall) How tall?
   (short and soft fur) Do you remember anything about their fur?
   (large and pointed ears) Do you remember anything about their ears?
   (bushy tail) Do you remember anything about their tail?

4. How do dingoes and farmers get along with each other?
   (they are enemies)

5. Why are dingoes and farmers enemies?
   (because dingoes kill farmers' sheep) (for food)

6. What did the farmers do to keep the dingoes away?
   (built a fence) (wire) (6000 miles long)

7. Where did ~~they~~ the farmers build ~~this~~ the fence?
   (around the desert)

8. Why did ~~they~~ the farmers build the fence ~~around the desert~~ where they did?
   (because that's where most dingoes live)

9. Does the fence keep the dingoes away from the sheep? Why (not)?
   (no) (dingoes are cunning (find ways through the fence))

10. What happens when the dingoes get through the fence?
    (they get the sheep)

PROBES: KIWI--EXPOSITORY

(Now I'm going to ask you questions about the kiwi story.)

1. What is a kiwi?
   (wingless) (bird)

2. In what country does the kiwi live?
   (Australia)

3. What does the kiwi look like?
   (wingless) Do you remember anything about its wings?
   (long beak) Do you remember anything about its beak?
   (feathers) (like silk thread) Do you remember anything about its feathers?

4. What are the kiwi's feet like? How many toes?
   (I don't know) (three)

5. What does it do to find food?
   (taps feet on soil)

6. What does the tapping the kiwi makes sound like?
   (a noise that sounds like falling rain)

7. What does the sound of pattering rain cause?
   (earthworms to come up out of the ground)

8. What happens when the worms appear?
   (the bird eats them)

9. Can the kiwi fly?
   (no--it's wingless)

PROBES: WOMBAT--EXPOSITORY

(Now I'm going to ask you some questions about the wombat story.)

1. What animals do wombats look like?
   (like ground hogs)

2. In what country do wombats live?
   (Australia)

3. Would you describe what they look like?
   (built low to the ground) Do you remember how they are built?
   (small eyes and nose) Do you remember anything about their eyes? Nose?
   (almost no tail) Do you remember what their tail is like?

4. What do wombats eat?
   (grass)

5. What do they use their large front teeth for?
   (to chew on roots and bark)

6. What are their legs like?
   (short)

7. What are their claws like?
   (strong digging claws)

8. What do they use their claws for?
   (to burrow a hole in the ground)

9. Why do they burrow a hole in the ground?
   (this is where they live)

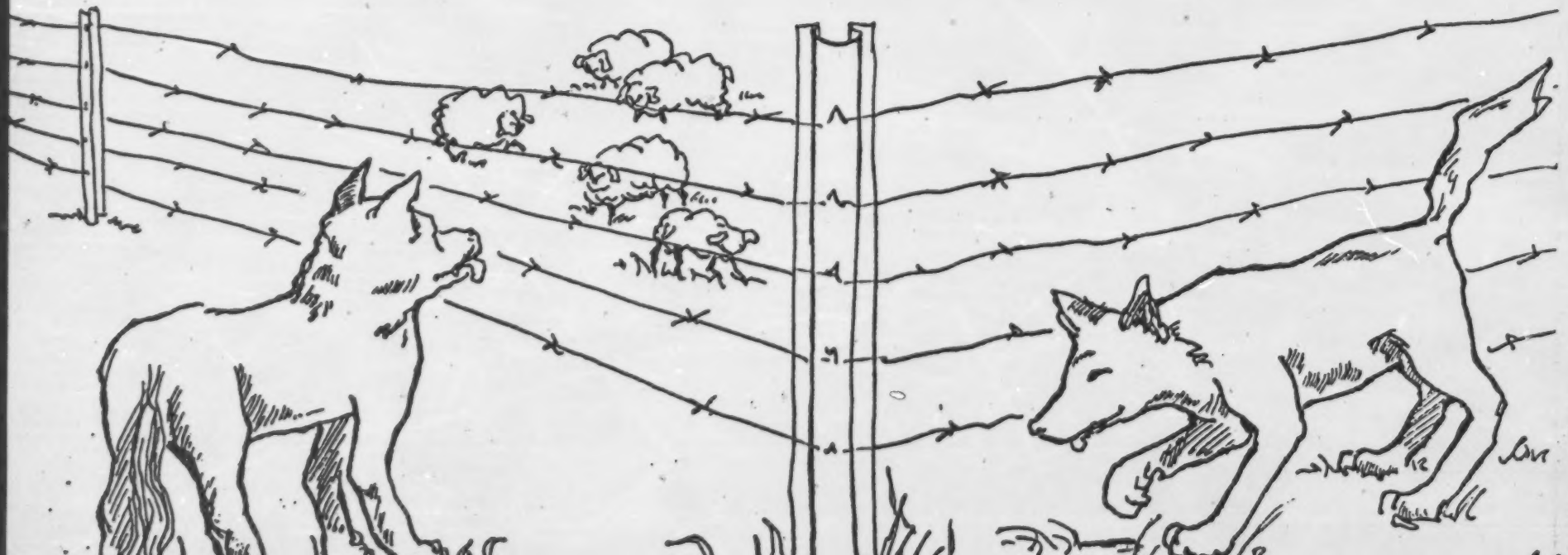
10. Who moves into old wombat holes?
    (rabbits)

APPENDIX C

EXPERIMENT 2: EXPERIMENTAL STIMULI

The kiwi is a wingless bird from Australia with a long beak and feathers that are like silk thread. The kiwi runs on feet that have three toes. To find food, it taps its feet on the soil to make a noise that sounds like falling rain. The sound of pattering rain causes earthworms to come up out of the ground. When the kiwi taps, worms appear and the bird eats them.

Dingoes are wild dogs that live in Australia. They are about two feet tall with short soft fur, large pointed ears, and bushy tails. The dingo is the farmers' enemy because it kills their sheep for its food. To keep the dingoes away, the farmers built a 6,000 mile-long fence around the desert where most dingoes live. But the cunning dingoes find ways through the fence to get to the flocks of sheep.



The New Guinea cuscus is a bug-eyed animal about the size of a house cat. It is covered with dense fur except for the lower half of its tail which has ridges to help it hang on branches of the eucalyptus trees. These slow-moving creatures rest aloft during the day on tree limbs or in hollow trunks. At night, they scout for food to eat. The cuscuses carry their young babies in pouches like the kangaroos.

The numbat is an Australian anteater with white bands across its back. Without its bushy seven inch tail, it is slightly larger than a rat. It has a dark stripe through each of its eyes, drawing attention to its sharp pointed nose. Its long sticky tongue can stretch several inches to easily catch thousands of termites which it licks up each day. Numbats do not have pouches so their babies cling to the mother's belly fur.

The cuscus, the size of a house cat, is a bug-eyed densely-furred animal from New Guinea. It inhabits eucalyptus trees and anchors itself to the branches by its prehensile tail, the lower half of which is hairless and covered with traction ridges. These slow-moving nocturnal creatures relax by day on tree limbs or in hollow trunks, and they forage by night for food. Like kangaroos, the cuscus carry their newborn in pouches.

APPENDIX D

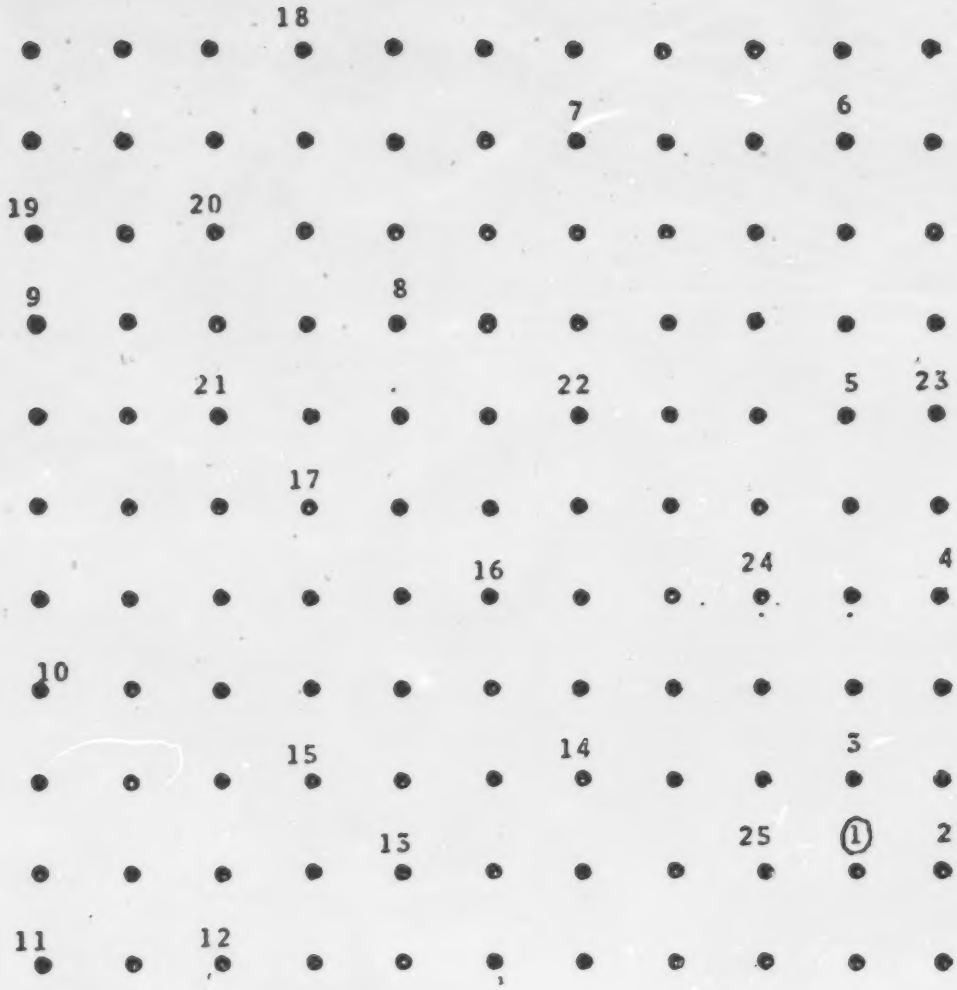
Example Test Booklets for Experiment 2

NAME _____

SCHOOL _____

TEACHER'S NAME _____

The kiwi is a wingless bird from Australia with a long beak and feathers that are like silk thread. The kiwi runs on feet that have three toes. To find food, it taps its feet on the soil to make a noise that sounds like falling rain. The sound of pattering rain causes earthworms to come up out of the ground. When the kiwi taps, worms appear and the bird eats them.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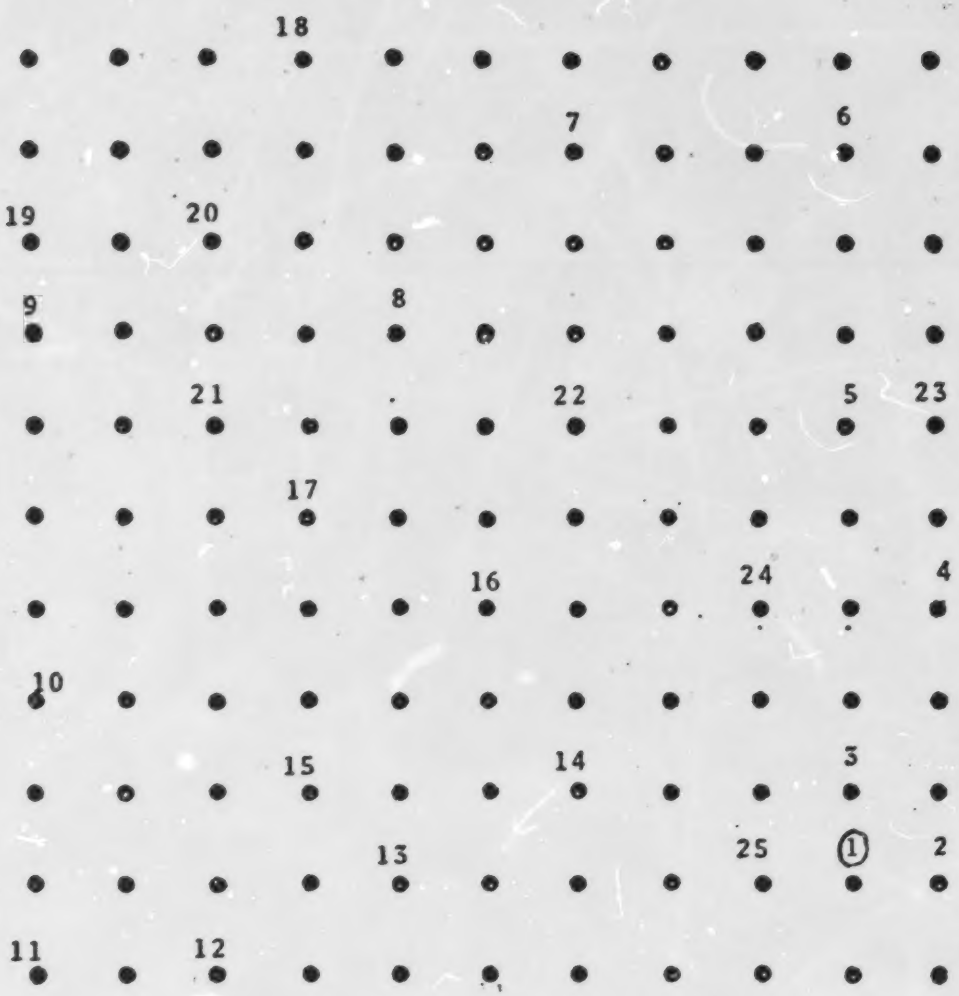
Please write everything you remember about the kiwi.

NAME _____

SCHOOL _____

TEACHER'S NAME _____

The kiwi is a wingless bird from Australia with a long beak and feathers that are like silk thread. The kiwi runs on feet that have three toes. To find food, it taps its feet on the soil to make a noise that sounds like falling rain. The sound of pattering rain causes earthworms to come up out of the ground. When the kiwi taps, worms appear and the bird eats them.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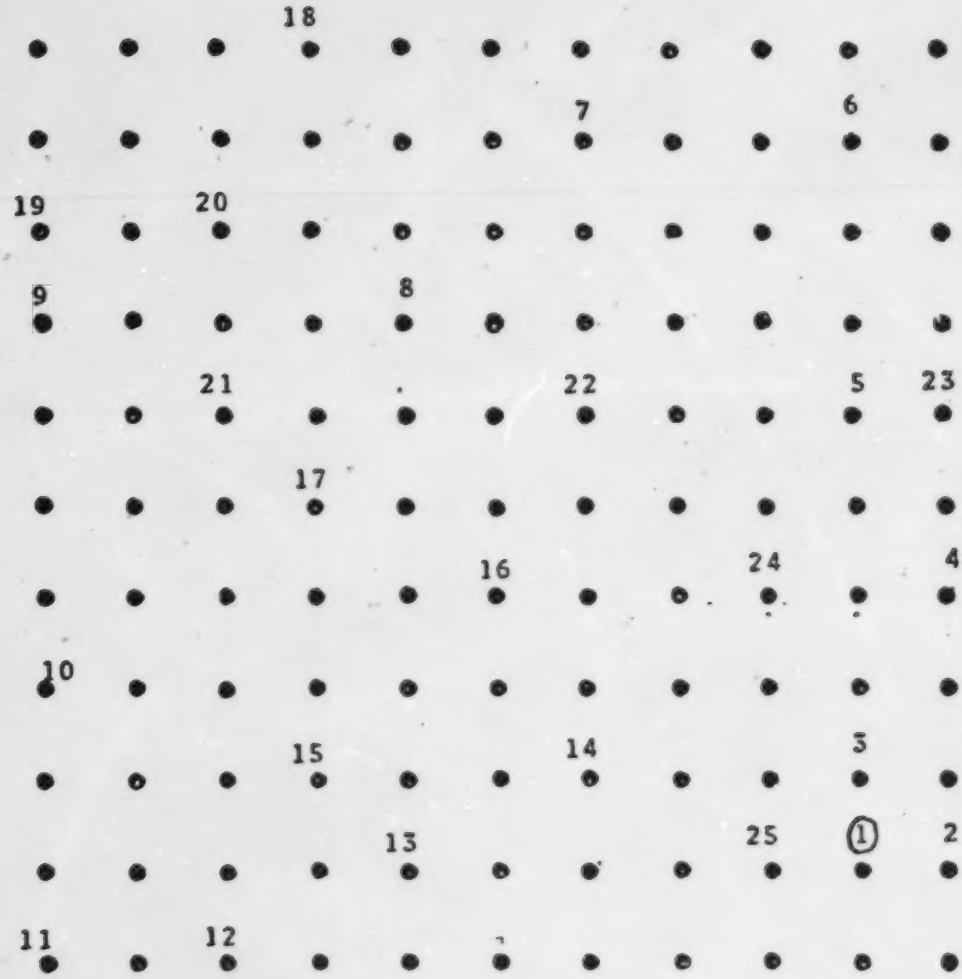
Please write everything you remember about the kiwi.

NAME _____

SCHOOL _____

TEACHER'S NAME _____

The kiwi is a wingless bird from Australia with a long beak and feathers that are like silk thread. The kiwi runs on feet that have three toes. To find food, it taps its feet on the soil to make a noise that sounds like falling rain. The sound of pattering rain causes earthworms to come up out of the ground. When the kiwi taps, worms appear and the bird eats them.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Please write everything you remember about the kiwi.

APPENDIX E

Subject Instructions for Experiment 2

PICTURE WITH and NO PICTURE

My name is Arlene. I am here today representing a group which is interested in working with publishers on developing stories for 4th graders, and we would like your help. What we are asking you to do today has nothing to do with your classwork; it is not a school test.

Please listen to the following directions very carefully. I will read them through once and then I will answer any questions you might have.

Show book> Each of you will be receiving two booklets with stories. Some of the stories have a related picture on the same page; some do not. Each booklet also has some blank sheets, a maze, and a lined sheet of paper. Make sure that your name is on the front of both booklets, and that you start with the booklet that has a NUMBER 1 on the top right-hand corner. Please fill in the blanks for your school's and teacher's names.

When I say, "We're ready; you may begin," please open your booklet to the story page. Please read the story carefully, trying to remember as many of the details as you can, because we're going to ask you to write down what you remember. You may take as long as you wish to read the story. You may find some words that are difficult. Try to figure out the meaning as best you can and continue reading. When you have finished reading, please turn to the next page; you may not go back to the story once you have turned the page.

On the next page, you will see a series of dots. Please follow the numbers and connect the dots. When you have finished the dot picture, please turn to the next page, which is a lined sheet. Write down as much as you remember from the story. Don't worry about spelling or punctuation; we are only interested in what you remember about the story. Please write or print neatly; we will need to read your stories later.

When you have finished the booklet, please turn it over on your desk and wait for my signal to start the second booklet. When you have completed the second booklet, please turn it over and wait for me (or your teacher) to come and get it. While you're waiting for someone to get your

booklets, please find some quiet work to do at your desk until everyone else is finished.

Are there any questions?

(Give out booklets.)

Please check for your name and Number 1 on the front of the booklet. Write in your school's and teacher's name, and do NOT open the booklet until I tell you.

We are ready now; you may begin.

PICTURE BEFORE

My name is Arlene. I am here today representing a group which is interested in working with publishers on developing stories for 4th graders, and we would like your help. What we are asking you to do today has nothing to do with your classwork; it is not a school test.

Please listen to the following directions very carefully. I will read them through once and then I will answer any questions you might have.

Each of you will receive a booklet that is made up of many pages. First there will be a picture to study; then there'll be a story related to that picture. In addition, the booklet has a maze and a lined sheet of paper. Make sure that your name is on the front of the booklet and that you start with the booklet marked Number 1 at the top right-hand corner. Please fill in the blanks for your school's and teacher's names.

When I say, "We're ready; you may begin," please open your booklet to the picture page. Do not go any farther until I tell you. Then you will turn to the story page. Please read the story carefully, trying to remember as many of the details as you can, because we're going to ask you to write down what you remember. You may take as long as you wish to read the story. You may find some words that are difficult. Try to figure out the meaning as best you can and continue reading. When you have finished reading, please turn to the next page; you may not go back to the story once you have turned the page.

On the next page, you will see a series of dots. Please follow the numbers and connect the dots. When you have finished the dot picture, please turn to the next page which is a lined sheet. Write down as much as you remember from the story. Don't worry about spelling or punctuation; we are only interested in what you remember about the story. Please write or print neatly; we will need to read your stories later.

When you have finished the booklet, please turn it over on your desk and wait for me (or your teacher) to come and get it. I will then give you another booklet, and we'll do the same procedure again. While you're waiting for me to collect your book, please find some quiet work to do at your desk

until everyone else is finished.

Are there any questions?

(Give out booklets.)

Please check for your name on the front of the booklet. Write in your school's and teacher's name, and do NOT open the booklet until I tell you.

We are ready now; you may begin. Please turn to the picture page, and do not turn past this page until I say so. Remember that this picture is related to the story that follows. (Count 5 seconds.) O.K. Now you can turn to the story page, and continue as we said earlier.